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BOTANY

PROBLEMS IN VEGETATIVE PROPAGATION OF *POPULUS*

BY

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The object of this work was preliminary research about the possibility of vegetative propagation of *Populus* from South Africa in spring in our country. The trees in that season, have completed growth in South Africa and in unpublished forestry experiments in The Netherlands cuttings had been found hard to shoot or, if they did, too late in the summer at our latitude for the new shoots to be mature before the end of the growing season. Ripeness is only ensured if the shoots should have reached a reasonable length by the *longest* day of the year (21th June).

Before we could recommend the method which has been already published [2] some research was necessary, part of which has been published [3], the other part of which is published here.

As we did not feel like commencing our experiments with cuttings the costs of which are high because of the air transport from South Africa, we decided performing our preliminary experiments with cuttings from Dutch material. These experiments had to be conducted during the autumn (1951) and the cuttings should have shooted and rooted by the *shortest* day of the year.

The problem we had to deal with in this case and should have to handle later on with the South African cuttings was renewal of growth in cuttings at a time when the parent trees had already gone into winterrest.

So it is a problem of dormancy breaking or of collecting the twigs at the right moment for the cuttings to be able to root and shoot. This, in any case, will be during the period of afterrest and perhaps in the preliminary rest period also. Under natural conditions in our country the state of afterrest for the buds commences in late winter or early spring, which is too late for the purpose in view. So it was evident, that success could be expected only if the commencement of the afterrest period could be shifted to an earlier date or if growth could be forced satisfactorily during the preliminary rest or the beginning of middle rest. Shifting of the afterrest period could be obtained by exposing the parent trees in summer to a day-length of 9 hours as it might be expected (MOSHKOV and KOCHERZHENKO [1]) that growth in such short-day trees would be completed sooner than in the long-day ones.

Another reason for experiments to be performed on short-day grown

Dutch parent trees was that the South African cuttings surely would be collected from short-day parent trees. Yet, the response of the genetically short-day cuttings from South Africa might be different from the response of our own cuttings from genetically long-day trees, though artificially grown as short-day ones. For this reason it was decided to use long-day parent tree cuttings as well. The latter ones, in autumn, were expected to be in preliminary or in beginning deep rest.

The species used is *Populus robusta* SCHNEIDER 15 young trees of which were available through the courtesy of Professor HOUTZAGERS. The trees have been planted 3 at a time in wooden tubs. As soon as the buds expanded (in the first days of May) 4 of the tubs were daily moved into and out of a blacked out, well ventilated greenhouse for the trees to get the short day of 9 hours in the open. The 5th tub was kept in the open air day and night in order to receive the long days of the Dutch summer. In both kinds of day length the trees grew well but there were marked differences between the two. The short-day trees as compared with the long-day ones (i) terminated growth more than a month ahead, by the end of June, with the formation of the bud scales of the new terminal bud, (ii) formed shoots twice as short and (iii) shed their leaves something over a month before the long-day trees did. Probably due to the mild climate in autumn 1951 leaf shedding was very late in both kinds of trees, the long-day parent trees being completely leafless only by the end of the first week of November. The trees then were 3 year old and had been received too late in spring for them to be decapitated and allowed to regenerate new buds from wound callus. The two year old twigs were collected for cuttings on the 19th November when the short-day trees could be expected to be in an early state of afterrest and the long-day trees in preliminary rest or beginning deep rest.

From the experiments it appeared that *shooting* in both kinds of cuttings was rather good and occurred within 14 days, especially in the short-day parent group where in one set of the experimental conditions all of the 4 cuttings shooted. In the long-day parent group the highest number was 3 out of 4. In both cases the higher number was reached in the set with dormancy broken by Molisch's hot water treatment and growth hormone application (for details see [3]). In the sets where both treatments were omitted no shooting occurred. With the short-day parent tree cuttings all 4 combinations of dormancy breaking and growth hormone treatment were tried. Due to shortage of material in the long-day parent tree cuttings two combinations only could be applied. These were: dormancy broken, growth hormone given, and: dormancy not broken, growth hormone applied.

Various light conditions were tried as well, 3 with the short-day parent cuttings and 2 with the long-day ones. This brought the number of trials up to 12 with the short-day material and up to 4 with the long-day material. Hence the low number of cuttings used per set which was further

reduced by the necessity of reserving more material for further research [3] and the budless condition of most cuttings of the 2-year old shoots.

From older literature it is obvious that long days are needed for the growth of poplar shoots, which in short days are soon stopping growth and forming end buds. In constant conditions of light this has been shown once again by VAN DER VEEN [5].

The 3 different light conditions were (i) the natural short autumn day brought up to 16 hours with TL light and (ii) with incandescent light, (iii) 16 hours of TL light, from sunrise until sunset simultaneously with daylight. With the long-day parent tree cuttings conditions (i) and (iii) were tried.

Rooting response of the cuttings was bad, in the short-day parent cuttings even worse than in the long-day ones. Many of the cuttings which had shooted had no roots at all by December 23, many others had only one or two and on the whole an average of 2 or 3 roots per cutting was found with no significant difference between the various combinations of dormancy breaking and growth hormone treatment. The highest number of roots — 6 per cutting — was found with the low intensity of the incandescent light group. The lowest number of roots and the lowest percentage of cuttings rooted was shown by the group with both TL light and daylight during the light period lengthened by TL light until the 16-hour day was completed. The rooting effect of the group in which day light had been brought up with TL light to 16 hours per day was in between the other light conditions.

These facts are in agreement with the work of STOUTEMYER and CLOSE [4]. These authors found that the orange red end of the spectrum is superior over other light colours tried. No attempt was made by them to "equalize the quanta intensities of the light". From a theoretical point of view it would be interesting to compare the effect of various light colours if the same amounts of energy are given. Such research is possible in Wageningen with the equipment WASSINK disposes of [6].

In many cases heavy rooting was obtained by STOUTEMYER and CLOSE. In our opinion heavy rooting perhaps might be obtained also with lower intensities of light or with other photoperiods than hitherto used. This suggestion arises from the above mentioned root formation which in none of the various light sources tried was satisfactory.

The daily photoperiods suggesting themselves are the normal winterday or *complete darkness*. The latter, of course, might be given for a rather short period only, the length of which depended on the rapidity of bud burst. Lower intensities, then, were reached at the same time.

The hypothesis has been tested and published [3]. The short winter day proved no good, but a period of about 14 days of complete darkness followed by long days was found to improve bud development as well as root formation. The method was found to render good results with both long-day and short-day parent tree cuttings. It, then, has been

applied with the short-day-parent-tree South African cuttings. Good shooting had taken place by the 21th June, while rooting at the end of the growing season (September) was likewise good [2]. For further details in connection with the provenance problem we refer to [3].

In autumn 1952 the hypothesis has been tested with long-day parent tree cuttings for comparison with the autumn 1951 results. Whereas formerly root formation with the long photoperiods was 1 or 3 or at the utmost 6 roots per cutting, the average number of roots now was 10,0 (in the October–November set) or 12,2 (in the November–December lot) with the dark period introduced into the propagating scheme.

Summary

Experiments with *Populus robusta* SCHNEIDER in 1951 suggested the hypothesis that in autumn rooting of cuttings of long-day parent trees and of short-day parent trees will be strongly promoted by growth in darkness prior to planting out in light conditions. The hypothesis has been proved in autumn 1952 trials and in experiments, already published, with Dutch cuttings [3] and with cuttings from South Africa [2].

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